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AN
INAUGURAL DISSERTATION,
FOR
THE DEGREE
OF
DOCTOR OF MEDICINE ;
SUBMITTED TO THE EXAMINATION
OF THE
REVEREND JOHN ANDREWS, D. D.
(PROVOST PRO TEMPORE),
THE
TRUSTEES AND MEDICAL PROFESSORS
OF THE
UNIVERSITY OF PENNSYLVANIA,
ON THE
EIGHTH DAY OF JUNE, 1803.

AN
INAUGURAL ESSAY;
ON
THE REMITTING AND INTERMITTING
BILIOUS FEVER,
OF
KING GEORGE & WESTMORELAND COUNTIES,
VIRGINIA.

BY HENRY ASHTON, S. S. M. P.

OF VIRGINIA ;

MEMBER OF THE AMERICAN LINNEAN SOCIETY.

“ Humanum est errare.”—

“ Felix, qui potuit rerum cognoscere causas.”

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—1803.—

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TO

JOHN PARNHAM, M. D.

THIS ESSAY is respectfully inscribed, as a tribute, pre-eminently, due to him; not merely, for his distinguished and almost parental attention to me, during the prosecution of my studies, under his direction; but, for the manly dignity of character, which he has ever maintained, in every vocation of life; and more especially, for the honourable rank, unto which, his exertions have raised the profession of medicine, in the state of Maryland; for which, he justly claims the highest place, in the esteem and gratitude of the whole medical world, as well as of

his affectionate pupil,

THE AUTHOR.

TO
ASHTON ALEXANDER, M. D.

THE merited celebrity of whose character, as a Physician, even at his present early state of life, I consider, as the example, by which, my industry has been stimulated, to attain to whatever proficiency, I have acquired, in the science of medicine ; this ESSAY is, in like manner, inscribed, as a tribute, justly due to him, for the many obligations conferred upon me, by his judicious and friendly counsel, polite attentions, and enlightened instruction ; and as a lasting memorial of the grateful regard of

His affectionate friend

And pupil,

THE AUTHOR.

INTRODUCTION.

THE reader will discover, in the perusal of this Essay, what he may consider a very important omission, I mean, my silence on the diseases incident to the middle situations between the Forest's and Neck's ; if however my sentiments on the subject are correct, the omission was not improper. Those situations consist of a range of broken hills, extending from one end to the other of the country described, for the most part, projecting considerably beyond the common boundary of the high lands, and, from their abrupt termination, almost hanging over the low grounds. These hills, from the beautiful prospects they afford of the magnificent grandeur of the Potomac river, and the meandering courses of the subordinate creeks, are made choice of as seats, by the most wealthy citizens ; from whence it happens, that in addition to the diversity of local influence, arising from this middle situation, all the complaints incident to these places, are modified, in a very great measure by the luxurious habits of their wealthy inhabitants.

The habits of this class of people are such as tend completely to obviate the natural influence of all partial causes, either concealing them from the possibility of discovery, by counteracting their sensible

operation, or driving them on, with a depravity of character unknown in the economy of nature:— Thus, naturally, half a drachm of mustard, if taken at once into the stomach, would produce violent effects upon the excitability of the system; but how often do we see men take with their meals twice that quantity, without feeling any inconvenience from it, nay that would be uneasy without that, or some other such stimulus. Half a drachm of laudanum, would produce very alarming effects on a person in his native state of excitability; but how often do we see a much larger quantity become, by habit, innocuous; indeed a stimulus, for a time, necessary for the support of life, and only to be abandoned by resorting to some other powerful incitant. Now it is an opinion in medicine, established by the clearest proofs, that, when the animal irritability has become callous, by habit, to the impressions of very strong stimulating powers, it can very rarely be roused into action by feebler incitants: For example, the horse that has been goaded by the spur, until he has become habituated to its smart, will be very rarely hurried by the feebler sting of the whip. And such is the state of the luxurious in all countries, they feed upon the most stimulating aliment they can possibly procure; and further, if they are not frequently intoxicated, they are daily under the influence of wine or ardent spirit.

And how is it possible that systems, thus stimulated by pepper, mustard and alcohol, can be excited by the feebler action of any of the common causes of disease: The difficulty indeed is manifested, by such persons being less subject to the common diseases of countries; yet these very people have, sometimes, modifications of all the affections incident to the poor and temperate; which is very happily explained by Dr. Rush, in his lectures on the Yel-

low Fever ; wherein he observes, that the Yellow Fever may be prevented by intoxication, which however must be without any intermission ; for as sobriety comes on, so does the Fever, and in such cases it is most certainly fatal. Thus, as the most abandoned in luxury, may, at some unguarded moment, be free from his accustomed stimulus ; some of the latent sparks of his excitability will be revived and give rise to disease : This disease however, though founded on a portion of native excitability, must take its course, through a system unsusceptible of any uniformly natural operations ; by which peculiarity of circumstances it is entirely directed, and the body, being accustomed to the most impetuous animal motions, in time of health, follows the same impulse when diseased ; from whence it happens that, in this class of people, most diseases appear in their most malignant forms. Now as the diseases are thus peculiarly modified, by the circumstances above alluded to, and as the habits of intemperance are so various in its different devotees, there must be such an infinite variety in their characters, as to render it impossible to give any connected and satisfactory account of their appearances ; for which reason I concluded, that no pleasure or advantage would be derived from any thing that could be delivered on the subject.

INAUGURAL ESSAY, &c.

AUTUMNAL fevers, as they appear in country situations, perhaps very rarely become so universal, as entirely to deserve the name of epidemic ; yet as the term epidemic may, with literal propriety, be applied to existing causes, though they do not act upon a great number of people, provided, a very great portion of those exposed to their action are affected by them ; I shall apply the term to the fevers, which I am to treat of in this Essay ; for although they are very rarely, if ever, so universal, as such diseases become in cities, nevertheless the causes often prevail with equal violence and would be equally extensive and mortal, if as great a number was exposed to their influence.

It is admitted on all sides, I believe, that in giving the history of an epidemic, it is of the first importance, to consider with attention and describe with candour, the influence of climate and local causes, in establishing the character of the disease and varying its forms and symptoms. The general character of all epidemics is given by the specific causes that produce them and the season and climate in which they appear ; but causes, entirely local, frequently vary the symp-

toms so much, as to obscure the general character and render it extremely difficult, nay, frequently impossible, to form a correct judgement of the class, order or genus to which a species should be referred, without being constantly mindful of the general monarchy of epidemics, whose laws, however absolute, are not entirely beyond the partial rivalry of local causes, which causes are frequently to be thoroughly investigated, before the legal potentate can be distinguished. Here therefore, it will be proper before treating of the epidemic itself, to give a brief account of the geography of the portion of country in which it prevails, almost annually, in autumn.

GEOGRAPHICAL SKETCH.

ON this head, I shall not pretend to give a very minute description of the country; nor shall I extend my observations to the whole of the two counties of King George and Westmoreland.—My place of residence is very near the line of division between the two counties, and as it is my intention to consider such circumstances only, as have been subject to my immediate and daily observation; I shall confine myself to a very small tract; extending not more than fifteen miles from north to south, and from five to ten miles from east to west. My short lived experience, even thus circumscribed, will be found but too defective, to answer the desired end, of delineating the most important circumstances of this place, as they produce diseases and modify their forms and characters.

Its situation is between 38° and 39° of north latitude, and between 2° and $2^{\circ} 20''$ west longitude from Philadelphia, on the west side of

the Potomac river; lying partly in both of the before mentioned counties. It is bounded on the north, by a line drawn from Boyd's hole to King George court house; south, by Mattox creek, which empties into the Potomac, east and north east, by the Potomac river, and west, by the ridge, which forms the back bone (as it were) of the northern neck, running nearly from one end to the other of the country lying between the Potomac and Rappahannoc rivers, being the source of those innumerable creeks, that every where traverse the lands on both sides of the ridge.

THE Potomac river is at this part considerably salt, so much so, that the inhabitants, during the revolutionary war, obtained chief part of their salt by evaporating the water. This saline quality is extended some distance up the creeks, giving to their marshes most of the properties of salt marshes.

THE general face of the country is extremely irregular and diversified, consisting of hills, valleys, flats, marshes and swamps almost innumerable. But that I may have some consistent plan, in giving the description, I shall assume the general division into forests or high-lands, and necks or low-lands. This division is not strictly applicable, as it refers to soil and situation; for there are, near the sources and on the branches of many of the creeks, extensive flats, which, according to the general division, would appertain to the forests, but which, both as to soil and several other properties, would come much more suitably under the division of low-lands. Nevertheless, as such situations are rarely made choice of for habitations, no inconvenience will result

to a work of this kind on that account. I will therefore, under the head of high-lands, include all that part, which lies next to the western boundary, forming part of the before mentioned ridge ; extending generally more than half way to the river, and terminating in a great number of broken hills, which generally end very abruptly in the formation of the low grounds ; which extend from thence to the river, being generally from ten to twenty feet above the surface of the water.

THE soil of the high-lands, particularly of the more interior part, is generally very poor, consisting chiefly of clay, with an admixture of a very fine sand and probably a small quantity of magnesian earth. From hence, as we advance nearer to the river, the sand diminishes in quantity and the clay acquires a redder cast, probably from its being lightly tinged with iron : But as we come to the termination into hills and vallies, near the low grounds, there is an entire change ; the soil is here when first cleared, extremely rich and fertile, consisting of a very fine black or reddish sand, well mixed with a light black mould : This however does *not* continue long ; for shortly after the land is put into cultivation, the whole of it is washed down from the hills into the vallies, and thence into the low-lands ; leaving the hills entirely denuded, and so poor as to require several years, to regain even a thin covering of grass or broom sedge.

THE soil of the low-lands, which as before stated, extend from the termination of the hills to the river, may, with propriety, be divided into three classes : The first, which is immediately below the hills, and extends but a little way from them, consists chiefly of a superstratum of the

soil washed down from the hills, lying upon a bed of argillaceous marle of a red colour, manifestly, from an impregnation of iron. The second, which extends from the extremity of the former, almost to the river, in most places; is a very deep bed of clay, the upper surface of which has in many places, a greasy appearance, with an admixture of a dark red sand, which gives the whole the appearance of the rust of iron moistened: in other parts, however, the clay has a dark tint, looks very dry, and wants the red sand. The whole of this soil, on account of its great tenacity of moisture, is, in wet seasons, very heavy and miry, and on the contrary, in dry seasons, so hard and brittle, as to render it impervious to the plough. The third division, which forms the soil of the river banks, consists of a similar bed of clay, with a superstratum of oyster shells, worn down to a coarse powder and intimately blended with a large quantity of the earth of vegetable decomposition, being the richest and most durable soil in that part of the country.

THE low lands are interspersed, in every direction, with many creeks and rivulets, the latter generally terminating in the former, and both together, at their origins and confluences, forming swamps and extensive marshes, that cover nearly one fourth of the face of the country. These swamps, in winter and during wet seasons, furnish the inhabitants with a great abundance of water, almost at their doors: but when circumstances are reversed, as to season, so they are, as to water; the supply then becomes small and the little can scarcely be used: for in consequence of the flatness of the land, and the little elevation of the sources of the greater part of the

streams, they very soon become stagnant and contract both the smell and taste of inflammable air ; which is nearly the impregnation of water stagnating upon mud, according to the experiments of Dr. Seybert, related in the fourth volume of the American Philosophical transactions. In short, the scarcity of water is sometimes so great and the quality so bad, that both men and stock linger and fall sick, from the want of it.—The swamps and marshes also produce, or rather promote the production of a very large quantity of musquitoes ; 'tis hardly necessary for me to add, that they do not lessen the other inconveniencies of these situations.

THE highlands, while they are much less fertile than the necks, possess many important advantages, with respect to situation, over them ; for, besides that they have very few musquitoes, the water, though perhaps not much more abundant, is, for the most part, of a very good quality ; as it issues directly from the great ridge, the sources are much elevated and the streams have considerable descent, whereby they are prevented from all stagnation. Having no marshes, they are also, for the most part, free from the influence of those noxious effluvia, that do so much injury to health, in the low-lands. But this is not uniformly the case ; for in the forests there are, here and there, extensive levels ; some parts of which generally descend into sinks, which when filled by rain, become stagnant pools, wherein putrefaction begins very soon, in warm weather ; for all of them contain, more or less vegetable matter, tending to that process. These however, can rarely become extensive sources of disease, as the water, in dry seasons, is very soon evaporated ; which puts an end to the putrefactive process. A much greater evil results from the vi-

einity of many large mill ponds, which becoming nearly empty, in long dry seasons, leave large surfaces of mud exposed to the sun, which of course produces a large evaporation of noxious miasmata.

THE climate is infinitely various during the winter and spring months, and probably much more so now than formerly. Many days are warm enough in winter to promote vegetation, and on the contrary, many in spring are so cold, as to nip the tender bud and bloom of early fruits, blasting the prospects of the ensuing season. The winters set in much later than formerly, and encroach much more upon the spring. Snows I believe, fall in less abundance and continue a shorter time on the earth than formerly. This may be one source of the frequent changes of temperature ; for in their stead, we have a greater frequency and abundance of rains, these quickly rising in vapours, cool the atmosphere excessively ; which, always seeking an equilibrium, forces currents of wind from the frigid mountains and cold back country, to the warmer temperature of the ocean. Thus are formed the north west winds, which are the great sources of cold, on this side the Allegheny. Rains are very frequent in spring also, as well as, in the winter, and are very generally followed, by changes of temperature : these changes lessen as the spring advances and summer begins ; 'till at length, towards the last of June, the climate becomes much more uniform ; rains are less frequent and evaporation less abundant, for the rains now generally descend in torrents and, therefore, quickly run down into the creeks and river ; enough however is generally evaporated to produce some change in the temperature of the atmosphere, but as the evapora-

tion is soon over, the consequent cold soon subsides. As the summer advances, the weather becomes more uniformly dry and sultry ; and from the first of August 'til the middle of September, there is generally a great scarcity of rain. The atmosphere being highly charged with electric matter ; light flying clouds frequently appear in the evenings, with much thunder and lightning ; but from the repulsion of the earth, now heated to a very great degree, they seldom descend in showers upon the land : This I conclude from their falling, for the most part, upon the river, which is less heated than the lands, or upon tracts of land that have been lately cooled, by accidental showers.

THE inhabitants of the low-lands are much more exposed to changes of temperature, than the foresters ; for they are, equally with them, subject to the western breezes, which generally blow from morning 'til noon, during August and September, and acquire a very great degree of heat, by their passage over an immense tract of country, the surface of which is for the most part red or yellow, colours that reflect nearly all the sun's rays : And they are, moreover, exposed to the eastern breezes, which generally blow, in the afternoon, from the river and are very cool at night, as long as they continue ; but either do not reach the forests, or lose their cooling influence first : whereby the foresters escape those evening chills, that prove so debilitating to the low-landers.

THE low-landers differ much in their habits of diet and exercise, from the foresters. The high-lands being generally poor, the labour of cultivation, if not lessened, is at least shortened ;

the crops come early to maturity, and the cultivator soon finds his labor at an end : This induces idleness and roving, and the peasantry generally occupy their time in fishing; which they commonly practice in the night or, at least, very frequently. Their fishing too, is generally, as much the effect of necessity as choice : for their poor lands furnish them with only a scanty supply of food ; they therefore fish for aliment, and live chief part of the summer and autumn upon little else. On the contrary, the low-landers find this the busiest season of the year ; which their neighbours are spending in idleness and fishing : the sultry heats of August and September produce no relaxation of their toils and labour ; every moment is necessarily occupied in the most laborious and fatiguing employments, in which they are exposed to the utmost vicissitudes of meridian heat and evening and morning cold ; in getting out wheat, making hay and cultivating and curing tobacco ; which last must be done, either at night when the dew is falling, or in the morning while every thing is still wet with it. The food of the low-landers is chiefly vegetable of the farinaceous kind, with a small quantity of salted meat. And the inhabitants of both divisions are much addicted to the use of ardent spirits.

HAVING premised thus much on the geography of this tract of country, and given a brief view of the climate and habits of the people : it will be useful, in this place, to give a summary account of the diseases that usually prevail in the winter and spring, and the early part of the summer ; more fully to illustrate the influence of local causes, in forming and varying the characters of diseases, thereby shewing what different changes are effected in the general system of health,

by the diseases, and predispositions to disease, that are the consequences of the same local circumstances, at different seasons ; for, whatever causes produce a great number of affections of the same kind, in a given time and place, must be viewed as having considerable, though remote influence, on the general characters of diseases, that are more strictly epidemic : thus, if a previous pleurisy, or recently cured dysentery predispose to bilious pleurisy, or bilious diarrhœa, in the succeeding autumn ; we may, upon the same principles, infer, that any other disease, or predisposition to it, might be attended by similar circumstances: I will here therefore take a very concise view of the subject, as it relates both to the high and low situations; not mentioning any of those disorders, that depend upon luxurious living or accidents, but only such as arise from climate, season and place, and have a manifest influence upon the character of the bilious fever, which is the object of this essay.

ABOUT the end of autumn or beginning of winter, when the cold weather first sets in; either from unusual exposure to night air, in gathering and housing the crops of Indian corn, which are done at this season; or from the great change of temperature, that usually takes place pretty abruptly at this time; catarrhs and influenzas are frequent, as well in the low, as the high lands; these are, however, for the most part, very slight; and seldom require the assistance of medicine : though sometimes the influenzas become so general, as to be thought contagious, going through whole families and neighbourhoods. Another disease, called by the vulgar inward fevers, and by Dr. Rush, febricula, is also very common, at this season of the year: this appears to be only

a modification, or last remnant of the late autumnal fevers; it is generally very slight, being the feeble successor of a worn-out tyrant; indeed, it very rarely exists as an independant disease, but usually combines with some other indispositions.—Slight rheumatic affections likewise occur, now and then, at this time.

As the winter advances and the weather becomes more severe, the catarrhs become more frequent and alarming, are often highly inflammatory, and sometimes, especially in the low lands, produce death. From this time there begins to be a difference, between the diseases of the high and low lands; the inflammatory diathesis being much greater in the latter than the former; every disease being more acute and tending to a more speedy termination in life or death. This, I believe, is a departure from the general order of things, for mountainous countries are said to produce more inflammatory diseases (*cæteris paribus*) than low lands; this circumstance, however, though perhaps difficult of explanation, must depend upon something in the situation of the place and the habits of the people. The greater prevalence of acute diseases in mountainous countries does not seem to depend, immediately, upon the situations, as they refer to particular cases; but only as they respect general health: thus mountainous situations produce a great degree of general health, and, of course, great vigour of constitution in their inhabitants; which constitutions are allowed, on all hands, to be the subjects of acute diseases; and if mountains were so circumstanced, as to diminish general health, the consequences would be reversed, and they would produce low chronic diseases: which is precisely what happens

here; for instead of the hardy and laborious employments of the mountaineers, instead of their simple and healthy diet and the pure spring water, which is their constant beverage; these foresters live, the greater part of the year, in idleness and dissipation, feed upon unwholesome aliment, with little nutriment, and use vinous drinks whenever they can get them; whereby they become less vigorous in constitution, than their more industrious neighbours of the low lands. But whether this explanation be deemed satisfactory, or not, the fact is undeniable, and therefore should never be forgotten, either in the pathological enquiry, or medical treatment of diseases, as they occur in the two different situations.

ABOUT the middle of winter, catarrhs begin to give place, particularly in the low lands, to anginas; these generally affect the uvula and tonsils, and are sometimes highly inflammatory, requiring bleeding, purging, vomiting, and what is most successful, sweating, after other evacuations: the same diseases occur also in the high lands; though not so early and in milder forms, rarely calling for the lancet. At the same time rheumatisms are frequent; but with the same distinction in the symptoms, on the one hand, requiring the liberal use of the lancet and other evacuants, and on the other, stimulants, tonics and rubefacients. This last disease is only incident to the laborious and others, who are much exposed to vicissitudes of heat and cold, in wet weather, and is probably very nearly allied to pleurisy; both depending upon the same causes and attacking very similar parts of the body; one having its seat in the ligaments of the joints and tendons of the muscles, the other in the

membrane lining the cavity of the thorax, and covering the lungs; and from the similarity in the species of inflammations, that take place in ligaments and membranes, I infer the identity of the two diseases.

PLEURISIES occur, indeed, now and then, at every season of the year, and become more frequent, after the commencement of winter; but in the months of February and March, when there is, almost constantly, a humid atmosphere, when the weather is constant in nothing but change, and the earth is continually inundated by snow and rain, pulmonary affections become almost epidemic; and as the causes exist pretty equally in both situations, the disease is perhaps not less frequent in the forests, than the low lands; but generally with the characteristic distinction before mentioned: Thus, while every case, in the latter, is highly acute and inflammatory, tending to speedy termination in death or abscess, which are only to be prevented, by the early and liberal use of the lancet, together with other copious evacuations; few cases, in the former, require, or will bear such treatment; the disease assuming a more chronic form, having considerable resemblance to the affection called peripneumonia notha and sometimes terminating in hydrothorax: In this form, the practice can rarely extend beyond gentle laxatives, diaphoretics and blisters; not unfrequently calling for the early use of stimulants and tonics. These affections are said to be less frequent now, than twenty years past: Does this depend upon the change of climate, or of manners? I think it probable, that both have their influence.

TOWARDS the latter part of March, and during the whole of April, a few cases of intermittents occur, partaking generally of the inflammatory constitution; they generally require blood-letting, or some other evacuation, before the use of bark. These intermittents decline, as the spring advances, and are removed entirely, by the more uniform temperature of May and June. These are the most agreeable and healthy months in the whole year, scarcely any disease is to be seen, except such as arise from accidents, intemperance, and the too liberal use of the fruits of the season; from which last cause, cholics are frequent at this time, especially in children; who indulge themselves in devouring large quantities of the fruits, that are not quite ripe; particularly, green cherries and apples; these prepare them for the cholera, which soon follows.—I have not before taken any notice of the diseases of children; perhaps with not so much impropriety, [as might, at first sight, appear; for, although they frequently have slight colds and sore throats in winter; yet, from their being much less exposed to the vicissitudes of the seasons, than adults, and from a less susceptibility of cold, they are very little subject to such indispositions, as depend upon those frequent alternations of heat and cold, which occur in winter and spring: their diseases being, for the most part, the effects of too much confinement and improper aliment.

THE last disease, which frequently preceds the heralds, or first signs of the bilious fever, is the dysentery; this generally begins early in July, and is sometimes very universal; though, in most cases, it is partial, appearing generally in the highlands, and influenced, in a very great measure, by local circumstances, being confined to situa-

tions, in the neighbourhood of mill-ponds, and the stagnant pools, mentioned in the geographical part. In ordinary seasons, it is thus partial, and so slight, as scarcely to excite attention; but during the last summer, when the sultry heats of that season sat in very suddenly, after some very heavy falls of rain, that filled all those sunken places in the forests; the consequent putrefaction and evaporation were so considerable, as to make the disease almost universal, and in many cases very alarming and distressing. But never, at this season, does it become so general or malignant, as when it occurs in autumn; for, it then depends upon the same cause, as the bilious fever; being either its substitute or successor: it is then highly epidemic, extending through whole neighbourhoods and proving fatal to great numbers.— Having thus considered all those causes, whose remote influence effect the character of the bilious fever, and in like manner, the circumstances of locality, that do it more immediately, I am now prepared to treat of the epidemic itself.

HISTORY OF THE BILIOUS FEVER.

To give a perfect history of an epidemic, with fidelity and impartiality, is one of the most difficult undertakings, in which, a writer on medical subjects can engage himself, and requires more candour, than is possessed by almost any man; for, besides the impossibility of collecting, by all the labour and industry, that any one person can exert, the whole information necessary for that purpose; there is such a propensity in the human mind, to assume theory as a leading principle, and to strain facts and observation, so as to accommodate them to such principle; that it is a

very rare thing, nay, I believe, a desideratum in medicine, to find an accurate description of any one epidemic, entirely free from such taint. It is certainly true, that to theorise is to be scientific on any subject; 'tis equally true, that every physician must practise empirically, who has no theory: this every student of medicine is taught, from the commencement, to the finishing of his studies; even in anatomy and surgery, the whole of which would seem to be entirely manual or mechanical, we still see the fascinating influence of theory; no wonder then, that the science of medicine should be so replete with the beautiful delusions of cause and effect, of reasoning and induction. But, notwithstanding the numerous and important improvements that have resulted to the practice of physic, from this mode of proceeding, many fatal errors have crept in, under the dazzling cloud of theory; and perhaps more, from this bias in the descriptions of the nature and symptoms of epidemics and their treatment, than from any other one source; for the success of any practice, in epidemic diseases, generally gives it the Imperial stamp of propriety, in all cases. Sensible, therefore, of the danger on that score, I will avoid, as much as possible, all reasoning on the subject, until I finish the general history of the disease; after which, I shall be forgiven, if my inclination should lead me to theorise on the facts before me.

To follow any system, in giving the history of the bilious fever, it will be necessary to consider it under the two following divisions:—1st, Its commencement, progress and final termination; with the different forms and changes that it assumes, as influenced by season, changes of weather and circumstances of locality: and, 2dly,

The symptoms of the disease, as it most commonly appears, in the forms of remitting and intermitting fevers.

1. *OF the commencement, progress, &c.*—The first appearance of the fever is rather ambiguous, it being difficult to say decisively, whether those cholics, which are frequent about the end of July and beginning of August, arise from the purgative nature of the summer fruits, or from the general causes, which induce the autumnal epidemics: This doubt is, however, soon converted into certainty; for the children become universally affected, with tormina and excoriations of the bowels, with dark bilious stools.—I said before, that children were more healthy in winter and spring than adults, from their being not so much exposed: but in summer, they are under very little restraint, and are therefore as much, if not more exposed, than any adults. From the quantity of green fruits which they devour, at this season, most of their affections turn upon the intestines; thus, they are very subject, at this time, to the disease called cholera infantum; the gripings and tenesmus, in this disease, are extremely violent and distressing, sometimes inducing convulsions; they are accompanied by nausea, vomiting and diarrhœa; the stools are frequently as black as ink; there is a remarkable hardness and prominency of the abdomen, as if distended by air, and frequently considerable emaciation. Death is not often the immediate consequence of these affections; but they now and then linger out into chronic diarrhœas, and finally destroy the patients. Similar cholics sometimes occur in adults, which produce diarrhœa or dysentery, and are generally attended by copious discharges of vitiated bile.

As the weather becomes more sultry and dry, and just before the commencement of the true billious fever, an universal lassitude prevails, many complain of their occupations being unusually irksom and fatiguing, the usual meals are taken, rather from habit, than choice; general want of appetite is lamented by the luxurious, thirst, especially in those, who are engaged in hard labour, becomes excessive and insupportable, they spend the greater part of their time in drinking and procuring fresh water, and if they have any ardent spirit, they usually take it to intoxication. Not a person seems to be entirely well, all are restless and dissatisfied, they know not why; this influence is remarkably manifested at every public meeting, scarcely a feast or party, of which they have many, at this season, passes off, without producing some proof of the general hurry of the passions; the mildest dispositions are, at this time, peculiarly susceptible of angry emotions, and the most gay and lively are frequently dejected and melancholy: unusual costiveness or laxity of the bowels are very general affections, at this time; pains in the limbs, like rheumatism, occur sometimes; headach, in such as are liable to that complaint by habit, is universal; the pains are violent and tormenting, and are vulgarly called sun pains, from a resemblance, which they have, to that disorder, denominated insolation, or a stroke of the sun: In such cases particularly, and likewise in many others, epistaxis is frequent, and sometimes proceeds to an alarming length.

ABOUT the middle of August, a few cases of the tertian occur, in such as are most predisposed to it; these are persons, who have been debilitated by unusual fatigue, or by living in situations, that are more exposed to the influence of

marsh miasmata than common. These solitary cases are, only the heralds of the host, that soon follows, spreading terror and devastation in its progress.—Towards the end of this month the disease becomes almost universal, in the low lands; the causes seem, in many seasons, to exert there whole influence at once, as if some very sudden and excessive change had taken place in the atmosphere, without a regular progressive advance, but, as it were, by storm, affecting whole families and neighbourhoods, almost at the same instant; so that, in the course of two or three days, there will be scarcely an individual, who has not been attacked: thus, the sufferings of the sick are greatly augmented, there being none well enough to attend them, except a few invalids, that were affected, at an earlier period; which, from some unknown law of the animal economy, seems to diminish the aptitude of the system to receive the same impression, so soon again. The disease generally progresses, increasing in violence and obstinacy, as long as the weather continues dry, few recovering entirely; the paroxysms, frequently, keep anticipating, 'til the tertians are changed into quotidians, and these, sometimes, into the more continued forms of remittents, taking on highly inflammatory or malignant symptoms. Few adults die at this time of the bilious fever; but many children, from the delicacy and extreme excitability of their systems, are affected with convulsions, from which very few recover.

AFTER the disease has gone on thus, for a short time, its progress is generally stopped, or suspended, by two or three heavy rains, that usually fall early in September, accompanied by great discharges of electricity from the clouds, in

dreadful explosions of thunder and lightning ; these suddenly cool and purify the air, and, at the same time, wash off the putrid matter from the marshes, and, for a time, destroy those sources of pestilence.—From this time the scene changes, the fever disappears, almost as suddenly, as it came on ; so that, it is quite a common thing, to see a whole family, or neighbourhood, sick and well in the same week.

THE poor foresters, who were, before, very little better than invalids, soon begin to perceive, that they have not been gainers, by the change of weather. The rains that were so much desired, and that proved so salutary to their neighbours, spread the seeds of the disease every where among them ; by filling up, and producing putrifaction in those sinks, that were, before, dry and inoffensive.—After a few days, the fever begins to make its appearance among them ; it generally commences in the tertian form ; but, in a little time, degenerates into the quotidian, becoming, under some circumstances, inflammatory, and, in a few cases, approaching to the malignant state ; this, however, is so rare, as scarcely ever to occur : But it generally assumes that form, called by Dr. Rush, the typhoid or chronic state of bilious fever ; being generally protracted beyond the eleventh day, and having its crisis, at some time, between that and the twentieth. It is frequently accompanied by so much direct debility, as to receive the appellation of nervous fever. The disease is not usually very mortal, in these situations ; but, now and then, in this chronic form, after long protraction, it proves fatal.—In common seasons, the disease does not become so general, in the forests, as in the low lands, and, though the sick do not recover very quickly, few

are attackéd, after a short time. Thus, it appears, that the epidemic is more limited in the forests, than in the low lands.

IN common, the disease makes no further progress, and the sick gradually recover from their indispositions ; but if the middle and latter part of September should be unusually dry and sultry, there is a renewal of the epidemic, in the low lands, and, for the most part, in a much more violent and malignant form than before ; it is also, if possible, more universal, not sparing even those whom it had before almost destroyed. And every thing seems now to favour its propagation ; for, in addition to the langour and debility consequent on its former prevalence, from which none entirely escaped, even those, who were before not entirely confined, having been, at least, reduced to a very advanced state of predisposing debility ; there appears, moreover, to be, at this time, an epidemic state of the atmosphere ; the brute creation, manifest it, by their dulness and neglect of exercise, often continuing, the gréater part of the day, in one place ; also, frequently, by a violent and sudden mortality, especially among horses and cattle. Two years ago, at this season, when the weather was extremely dry, a great number of horses were strangely affected with excoriations of the nose, mouth and œsophagus ; the tongue was very much swelled, and either entirely denuded of the epithelion, or covered with vesications, containing a yellow serum. The rot in sheep is sometimes very fatal at this season ; and all the young fowls linger and die, without unusual care and attention. The vegetable process, on which, according to the experiments of Priestley, the salubriety of the air, in a great

measure, depends, seems now to be at a stand ; the wheat, that is sown, frequently lies several weeks in the earth, without shewing any marks of vegetation, the clover and grass lots become dry and scorched, the leaves of the Indian corn shrivel and turn yellow, and often whole fields become (as the planters term it) fired ; all the fruits of the season ripen earlier than usual, and are sometimes more delicious, than in healthier seasons. The weather is now uniformly calm and serene ; frequently not a cloud is to be seen for several days together, and not a breath of wind is to be perceived, except gentle breezes in the evening, from the river, and now and then, a light one, in the morning, from the south-west. While the meridian heats are yet almost as great as in July and August ; the nights are generally cool, becoming towards morning quite cold and disagreeable ; the variation of temperature is not unfrequently, in 24 hours, from 50 or 55° of Farenheit. to 80 or 85°. In addition to the above circumstances, there are multitudes of musquitoes, which are now of an unusual size, their bites frequently fester, appear like large blotches, inflame for a considerable distance around, and sometimes degenerate into disagreeable and obstinate ulcers.

THE fever commences, at this time, in the tertian form, as before, but anticipates rapidly, in some cases, by the the third paroxism, it becomes quotidian, and soon after remittent. In these, which are the most violent cases only, the remissions are scarcely perceptible, and but for the exacerbations, the disease would always be denominated a continued fever. The inflammatory symptoms now frequently run very high, passing sometimes into the malignant form ; a few cases

are so much like the true yellow fever, as to induce some of the physicians of the place, on very good grounds, to call the disease by that name. The yellow skin is by no means a rare occurrence, the white of the eyes generally becomes yellow ; in some cases the bile, that is puked up, is almost black, so as, very justly, to deserve the name of black vomit ; the stools are also, at the same time, as black as ink ; but that kind of vomit, which has been compared to coffee-grounds, I believe never occurs ; which is, perhaps, the only characteristic distinction, between this fever and the genuine yellow fever. In this state, the bilious fever is very formidable, and requires the utmost attention, on the part of the physician, to prevent a fatal termination, on, or before the seventh day. Many deaths occur, from this stage of the epidemic, and the mortality seems to be much greater in children and young people, than in those more advanced in life, and, I think, less in the blacks, than the whites ; although the former are much more exposed to the disease, and receive, less attendance when they are sick. The disease continues, nearly in this form, until the weather changes ; but with this difference, that the cases become more chronic and protracted, in proportion as the season advances.

ABOUT the first of October, or between that and the middle of the month, there is, generally, some very considerable change in the weather ; it becomes much cooler, and commonly produces a little frost. From this time, the bilious fever begins to disappear, leaving behind it, however, many chronic affections, to fill up the rear ; such as obstinate diarrhœas, and some visceral obstructions ; of these, a distended spleen is one of the most universal, attended, sometimes, by tor-

por of the liver, and great diminution of the biliary secretion; the countenance, in these cases, is sallow, and there is great tendency to jaundice, the appetite is impaired; there is much intestinal debility, costiveness, and general emaciation, which, not unfrequently, end in ascites.

2. *Of the Symptoms of the Bilious Fever.*—

These are varied by season, situation and constitution; but as it would be tedious, and require frequent repetitions, of nearly the same words and substance, to consider, under separate heads, all the varieties resulting from those circumstances: I will describe the symptoms, as they generally occur, noticing, as I proceed, such departures from the usual character, as are more obvious and worthy of attention, especially such as may tend to point out the necessity of any considerable diversity in the medical treatment.

THE first symptoms are the premonitory, which are want of appetite, and unusual lassitude, for several days previous to the disease; also costiveness, and sometimes the reverse, or diarrhœa, with considerable griping and tenesmus, the feces being either green or yellow, indicating the presence of bile; there is very little urine, and that of a very deep red colour; pains running down the spine, dull and heavy soreness in the lumbar region, with stiffness, and a sensation of gnawing, in the joints of the extremities, are, pretty often, precursors; also, for several days, there are frequent shooting pains in the head, heaviness of the eyes and giddiness, which sometimes tends to vertigo upon first rising from a seat; very commonly, for two or three mornings before an attack, there is considerable nausea, and sometimes vomiting, upon first getting out of bed; there is likewise great thirst for

several days, accompanied by a dry and white tongue, indicating the presence of some fever; the nose is dry, and the breath seems to scald, as it passes through the nostrils; the thorax seems to dilite with difficulty, and the air appears to be thrown out from the lungs with a convulsive motion, as if rejected, and the respiration is, for the most part, quick and sonorous.

WHEN the disease commences its attack, which it commonly does in the morning; the first symptom is a slight rigour, accompanied by sensations of coldness, and shortly after a little nausea, which goes off, and the rigour is renewed, becoming now more strong and general; the finger nails turn purple, and the extremities grow cold: as the rigour increases, the convulsive action in the muscles of the lower jaw becomes tremulous, with, every now and then, a trismatic gripe. The spasms in the muscles, generally, become now extremely painful, especially in the back approaching to the affection, called *opros-thotonos*. The agues, however, do not commonly proceed to this height; but are terminated by violent nausea, and reaching to vomit, which continues for some time; till at length the diaphragm and abdominal muscles take on such forcible contractions, as to render the action of vomiting irresistible: large quantities of a frothy matter called phlegm, which is, probably, nothing more than acrated gastric liquor, mixed with a little intestinal mucus, is first discharged; but, after a while, the vomits consist, entirely, of a greenish or dark yellow bile, extremely acrid, and, sometimes, at first, highly viscid, nearly of the consistence of jelly. The puking, sometimes, goes to a violent and alarming length, assuming the form of *cholera morbus*; this, however, is a

rare occurrence, and, generally, when there is no peculiar irritability of the stomach and intestines, after several fits of straining and puking, the sickness at stomach subsides and gives place to the fever.

THE symptoms in the blood vessels, during the whole continuance of the chilly fit, are indicated by a feeble and frequent pulse, slow and tremulous in its motion, with, now and then, a slight intermission : when the nausea is at its height, the pulse is scarcely perceptible ; but, as soon as the patient begins to vomit, there is, usually, an evident augmentation of the fullness of the stroke of the artery. Great heat of body now succeeds to the chill ; the pulse becomes hard and bounding, and beats much quicker than before ; the blood seems to have a peculiar determination to the head, the temporal arteries beat with a super-proportioned strength, while the vessels of the brain are turgid, and keep a perpetual roaring, as if something from without were constantly striking against the membranæ tympani. As the paroxysm advances, the pulse becomes less frequent, but much quicker, and seems somewhat more tense and contracted, in size. After advancing to this stage, in the generality of cases, the paroxysm soon reaches its crisis ; a perspiration now breaks out, the pulse becomes more full and free, also slower and less frequent, and, at length, natural ; or, perhaps, more commonly, less than natural.

As soon as the rigour is over, the body, as before mentioned, becomes hot, the skin is dry, and has a sensation of burning ; so that the patient is constantly tossing in bed, from one side to the other, turning over his pillow as often, that a

cool surface may be brought into contact with his skin; the thirst is generally very great, during the whole paroxysm, and the saliva is extremely tenacious and viscid, producing a very disagreeable taste in the mouth; the respiration is quick and laborious, and, at the height of the fit, there is an anxiety, so great, as to feel like an intolerance of life itself; this is augmented by a severe pain in the temples and forehead, throbbing thro' the brain, and an irritability of the eyes, that makes light insupportable; but when the sweat breaks out, a calm sleep generally comes on; from which the patient awakes, entirely relieved of all those distressing symptoms, except considerable weakness, and, for the most part, a slight pain in the head; which is increased by getting up. The urine discharged, during the fever, is small in quantity and extremely high coloured; but, after the fit is over, is rather turbid, and deposits a lateritious sediment of a red colour.

SUCH is the usual appearance of the fever, at its first commencement; but if, from any circumstances of situation or constitution, it should be destined to become more violent and continued, there is no crisis, the sweat either does not appear at all, or is in very small quantity, and soon subsides; the symptoms, instead of going off entirely, only decline gradually, leaving the patient better, but not well; the apyrexia is, by no means complete, and the next exacerbation is found to have anticipated, considerably, the expected time of accession: thus, a tertian becomes immediately quotidian or remittent. In these forms, especially in the last, all the symptoms are highly aggravated, and, in the low marshy situations, approach, very nearly, to the type of the malignant yellow fever; the eyes acquire a yellow

tinge, as in slight cases of jaundice, and the skin assumes all the varieties of colours or shades, between a pale livid hue and a bright yellow, frequently changing from one to another, several times, in the course of a day, 'til at length it becomes all over permanent yellow ; even the nails, and palms of the hands, acquire the same colour. Every secretion seems to be either suspended or impaired ; the bile is diminished in quantity, and has a highly morbid appearance, being, in many cases, almost black ; and, from its acrimony, keeps up a continual nausea and griping. The pain in the head is most tormenting, the pulse diminishes in fullness, but is very tense and quick : and, while the vital and animal functions are thus deranged, the mind is not in a better state ; an active delirium comes on, which sometimes proceeds, almost, to phrensy, and continues, with little intermission, through the whole disease ; and, in delicate female constitutions, leaves a kind of hysteric amentia, for several days, after the fever has ceased. In other cases of the more continued form, especially in the forests, the disease takes on the type, called by Dr. Rush, typhoid or chronic ; for, as they become more continued, the symptoms are less acute, but more obstinate, the sickness at stomach is much less, the pulse is tense, corded and contracted, and the delirium is of the low melancholic kind.—But the symptoms are much influenced, in every situation, by the constitution and habits of the patient.

THE symptoms of prognosis, are as follow : If the second paroxysm anticipate much, the fever will become more continued, and vice versa : The length of the paroxysm is, usually, in proportion, with the duration of the rigour ; and the longer the paroxysm, the greater is the danger ;

if the fever goes off with a universal sweat, followed by a calm sleep, the intermission will be complete, and the disease mild; but if the sweat should be partial, and go off before the crisis, there will not be a complete intermission. A very high and long continued delirium is unfavourable; a very dry dark tongue is a very bad omen; excessive thirst is also unfavorable. In children convulsions are fatal symptoms; likewise drawing up the shoulders, drawing the chin down upon the breast, and strong contractions of the limbs portend a fatal issue, in adults, so does a sullen, dejected countenance, with obstinate silence. Eruptions and scabs about the mouth are indications that the violence of the disease is over.

HAVING now finished the history of the epidemic, it were, perhaps better that I should make an end of my essay; yet, the charms of theory are so great and alluring, that I must follow the Syren even to the brink of the precipice.

THEORY OF THE BILIOUS FEVER.

THE object of this part of my essay is to enquire, what are the agents that produce the bilious fever, and the manner in which they act upon the human body; the subject is, therefore, naturally divided into the predisposing causes, and their operation.

IT may appear strange to some, that I should attribute the whole production of the disease to the predisposing causes; but in that there is no inconsistency; for I hold it as a certain truth, that all epidemics owe their specific identity of character, not to the exciting or proximate causes, which either are, or may be the same, in every different state or form of fever; but to the predisposing altogether. This I not only infer, from the authority of the medical schools, the doctrines of all which, though not in direct words, do, in reality, favour this opinion; but moreover maintain, by the fairest induction, from some conclusive arguments, founded on the operation of specific contagions on the human body. From the small-pox and jail fever we have the most remarkable illustrations of my position: If a man, in health, should go into a small-pox hospital, or into a dungeon, where many were affected by the jail fever, though the fetor were sufficient to produce syncope or death, neither the disease of small-pox, or jail fever,

could be supposed to exist in the person so affected: and if (what generally happens) the person, after leaving those places, should be sick for several hours, he will shew no symptoms of either small-pox or jail fever: for, notwithstanding the very great specific difference between the two diseases, the immediate effects will be exactly the same from both; thus, though the contagion of any disease may produce some immediate effects, in a high degree of concentration; yet they are very little different from those of any other fœtor, equally nauseous, and cannot produce diseases, of their own type, until their continued action, upon the healthy economy, has produced predisposition to their several diseases. And further, if a predisposition to small-pox has been nearly formed, by the action of the contagion, for several days, upon the body, and a violent exciting cause of fever, should then be superadded; the disease of small-pox will be produced, several days earlier, than it is, in ordinary circumstances; clearly proving, that any other stimulus may excite the variolous fever, after the predisposition has been formed, as well as the contagion of small-pox. But what, I think, places the point beyond a doubt, is, that when sporadic cases of small pox appear, during the reign of any other epidemics; for instance, the plague, or yellow fever; the small-pox does not, then, by any means, display the appearances of its own specific character; but, in fact, is nothing more than a variolous modification of the plague, or yellow fever.

Of the predisposing causes.—It has been too much the custom, ever since the earliest ages of medicine, to refer epidemic diseases to the influence of some super-terrestrial agents; some at-

tributing them to divine vengeance, and others to the moon, stars, and comets. To the sun, indeed, as the great source of heat and light, much influence may justly be attributed; but, as to the others, not even the slightest probability can be adduced, to prove their action, in such cases; wherefore, it would be highly unphilosophic, to allow them any share in the production of epidemics.—Whatever there is diliterious, in our atmosphere, must be derived from the earth, by the universal agency of heat and light, to the earth, therefore, alone, are we to look for the causes of disease; but, no body of the animal or vegetable kingdom, while alive and in health, can be considered as an extensive cause of disease, and minerals are very rarely to be esteemed such. We are compelled, therefore, to search for the causes of disease, in a morbid state of vegetable and animal matters, assisted by the action of heat; which first renders them unsalutary, and afterwards elevates them from their beds, and gives them currency through the atmosphere. Heat, however, can only elevate and spread abroad the volatile parts of bodies, the fixed remaining harmless upon the earth; thus, the volatile parts alone can be the causes of epidemics, and as animal substances, by their putrification, can rarely be extensive causes of disease, in country situations, I shall here confine myself to the examination of the volatile principles of vegetable decomposition, under the particular modification of marsh miasmata; afterwards noticing the assistance they receive, in forming the predisposition to the disease, from the constant alternations of heat and cold in autumn.

THOSE noxious exhalations, arising from putrifying vegetable substances, denominated

marsh miasmata, have, ever since the age of Hypocrates, been considered as the principal agents, in the production of all the epidemics, in every quarter of the world, under the forms of bilious remitting and intermitting fevers; nor does the opinion seem ever to have been doubted, until very late in the last century. The chymical philosophers, however, (who, without remorse, tear down the fair theories, if they find only one corner of the airy edifice standing on a pillar, unable to defy their tests infallable) have lately declared such contaminations of the atmosphere to be undiscoverable, innocuous and nothing but the offspring of the imagination. This declaration coming from the unerring arbiters of science, who found their decisions, upon the broad basis of undeniable experiments, for a while, disconcerted some of the medical theorists, in their explanations of the phenomena and causes of the autumnal bilious diseases. But though it was denied, that any thing deleterious was added to the air, it was still possible, that the diseases might arise, from the abstraction of something necessary for the support of health. And there are not wanting some, who immediately embraced the opinion, that the bilious fever, of marshy countries, is the effect of a diminution of the vital principle in the atmosphere, caused, by the quantity of that part of the common air, destroyed or absorbed by putrifaction. This doctrine, however, was very soon contradicted by the chemists, who pronounced, positively, that there was no difference in the purity of the air, in different places, (i. e.) that the relative proportion was the same, in every part of the world, between the vital and azotic airs, in the atmosphere. But, convinced, myself, that the peculiar circumstances of marshy situations, with respect to their di-

seasons, cannot depend, entirely, upon the alternations of heat and cold; (which, is now the opinion of those, who, at first, gave up the doctrine of measmata,) I determined to prosecute the experiments still further, on the properties of marsh air, and, endeavour, if possible, to effect some conciliation of the difference, between theory and experiment; for which purpose, by the condescending politeness of Dr. Woodhouse, professor of chemistry in the University, whose accuracy, in chemical experiments, none will dispute, the following analyses of marsh air were effected.

HAVING obtained, in separate bottles, two portions of the air, that is constantly evolving from the bottom of a marshy part of the Schuylkill river; they were, each, submitted to the following experiments, to ascertain their constituent parts.

I. ANALYSIS.—*Experiment 1.*—A measure of one hundred parts of the air was passed through lime-water in an eudiometer, whereby no turbid appearance, or absorption was produced, which proved, that there was no carbonic acid gas in the air.

Experiment 2.—A measure of one hundred parts of pure nitrous air, obtained by the action of nitric acid upon copper, being added to the same quantity of the marsh air, in the eudiometer, no absorption was produced; which proved, that there was no oxygen gas in the air, for, if there had been, nitric acid would have been formed, and absorbed by the water in the hydro-pneumatic apparatus.

Experiment 3.—An ounce measure of oxygen air, of a very high degree of purity, obtained from turbith mineral, was added to two of the same measures of the marsh air, in the eudiometer of Volta ; which could not be exploded by the electric spark ; which was, however, readily affected, after the addition of a second measure of oxygen gas ; the explosion was pretty loud, and one ounce measure and an half disappeared, having been converted into water. The air left in the eudiometer was found, upon examination, to contain twelve and an half per cent of carbonic acid gas, after the separation of which, from the air still remaining, the last was found to be, yet, highly inflammable, burning with a blueish flame, from whence I conclude, that the air was a pure hydrocarbonate.

II. ANALYSIS.—The two first experiments turned out exactly as before. The third was a little different. One ounce measure of oxygen having been added, as before, no explosion was produced ; which, however, was effected, by adding a second measure, but the explosion was less violent than before ; only half a measure was converted into water, and the quantity of carbonic acid gas was found to be only seven per cent.

Experiment 4.—To two ounce measures of the marsh air, two and an half of oxygen gas were added, as before, the explosion was now violent, one and an half measures disappeared, and the quantity of carbonic acid was found to be twenty-five per cent. The remaining air still burned with a lively bluish flame. From the two last experiments it appears, that the hydrocarbonates vary, in the proportions of carbon, the air in the first bottle containing much less, than that

in the second. And there is another inference to be drawn, I think, from all the experiments with electricity, viz. that the affinity of oxygen both for hydrogen and carbon is diminished, by the combination of the two last, in the form of hydrocarbonates, otherwise the explosion would have been more easily effected by the electric spark, and a greater quantity of carbonic acid would have been formed, in the third experiment on both bottles: and further, the affinity of oxygen for the carbon appears to be increased, in proportion to the increase of the quantity of the latter, in the hydrocarbonates; from whence happened the greater relative formation of carbonic acid, in the last experiment.

THESE experiments prove two things; first, that the air evolved, in such large quantities, from the surfaces of marshes and the bottoms of stagnant waters, is a true carbonated hydrogen gas, unimpregnated with carbonic acid gas, atmospheric or azotic airs; and secondly, that, as this air is lighter than the atmospheric air, it must rise up and blend itself with it, and thereby form, what has been called marsh miasmata. And, it is in vain that the chemists deny it; for if I were to pour an ounce of Fowler's solution of arsenic into a butt of water, all the experiments of a Lavoisier, a Priestley, or any other celebrated chemists, if unsuccessful in the attempt to discover it, would be insufficient to prove, that there was no arsenic in the water, the fact would remain irresistible, and all, who saw it, would be constrained to believe it: so it is with the carbonated hydrogen gas, we see it discharged into the atmosphere, and, therefore, cannot doubt its presence. The chemists, indeed, say, that as fast as it is discharged from the mud

or water, it is extensively diffused through the air, and thereby prevented from contaminating any one place more than another. That it is soon dispersed, I can readily admit; so is heat, when discharged from a fire; but who does not know, that the nearer he stands to a fire, the greater will be its action on him? Another subterfuge of some of the chemists is, that the marsh air is decomposed, as soon as it reaches the atmospheric air, the oxygen of the latter uniting with the carbon of the former, and causing it to descend again to the surface of the water, from whence it arose, by which the carbonic acid, formed by this new union, is very quickly absorbed: this, however, there is much reason to doubt; for it was proved, by the third experiment, that equal parts of this air and pure oxygen did not unite, without the electric spark, and, even after the union was affected, the quantity of carbonic acid formed was very small, in proportion to the carbon contained in the air; especially in the second analysis, where the residue of carbon was proved to be great, by the fourth experiment. Is it not reasonable, therefore, to conclude, as the difficulty of decomposition was so great, with pure oxygen gas, that a very considerable time must be requisite, to effect the same end, when the proportion of oxygen is only as one to three in the atmosphere; when it is recollected moreover, that pure oxygen and hydrogen do not unite very soon, without a degree of temperature much higher, than the greatest heat of our climate. But this is not all; the marsh air is frequently manifested to our senses; who, that has ever passed by a marsh, in a very hot day, has been insensible to a noxious odour, that is constantly escaping from its surface? And who that has ever

smelled that odour, and compared it with the odour of carborated hydrogen gas, can have failed to have been struck with their undistinguishing sameness. From what has been said, the chemists seem to have erred, in their decision concerning the state of the atmosphere, and will, I am convinced, be ready to admit the fallacy of experiment, and acknowledge, that notwithstanding they have no tests nice enough to detect the presence of a minute portion of miasm in the air, still, it would be unphilosophic to deny every thing, that their science is, at this early state of improvement, unable to demonstrate by experiment. Having now sufficiently established, that the atmosphere is contaminated by miasmata, in marshy situations, and having also ascertained, that the different species of hydrocarbonates are what essentially constitute those miasmata; it remains still to prove that they are the causes, which produce the autumnal bilious fevers.

It will be necessary, first, to prove that these hydrocarbonates possess properties noxious to animal life; which I think cannot fairly be denied, when it is recollected, that whatever is very offensive to the smell, is found always to contain some narcotic principle. But in the present state of chemical knowledge, if there were not many, who pay no attention to that science, I should deem it entirely unnecessary to add any thing further, to establish, that this air, in a highly concentrated state, is not only noxious, but very quickly fatal to animal life; therefore, for the satisfaction of those only, who do not know the fact, I will make one quotation, from a learned author, in proof of their deleterious properties;* “Dr. Van

* Ontyd on mortal diseases.

Guens relates a case of a well exhaling so offensive, putrid and penetrating a stench, that a labourer descending into it instantly lost all sense and motion, and when drawn out into the open air was seized with convulsions; at length coming to himself, after three hours, his brain remained disturbed during the whole night. Another less suddenly affected by the stink, was affected longer in his brain: both, nevertheless, recovered in a few days. Though the doctor does not speak of the nature of this exhalation; yet, it seems to me, that it may be concluded from the circumstances, with sufficient certainty that the carbonated hydrogen gas was the cause of these symptoms". Now, if its effects are so violent, in a concentrated state, it will not be very difficult to believe, that in a more diluted state, it may act with sufficient force to produce effects of a very malignant kind, by long and continued application; such as the symptoms of bilious fever; which disease requires, that the causes producing it, should either be applied for a long time, or that they should be in a very active state. It may, indeed, be objected, that if the portion of miasm is so small, as not to be discoverable by the nicest chemical tests, it can have very little power of producing disease; but the same objection would be just as applicable to all contagions, what chemist would pretend to detect the contagion of measles floating in the atmosphere of a neighbourhood, or even of a large room? Yet, who does not know, that if a person, susceptible of the disease, should expose himself to a room, or neighbourhood so infected, he will not fail to have the measles?—It will not, I trust, require any further illustration, to satisfy every unprejudiced mind, that miasmata do exist in the

atmosphere over marshy countries, that those miasmata are hydrocarbonates, and that those hydrocarbonates are capable of producing diseases.

IF those points are fairly established, it will be a very easy matter to prove, that the bilious fever arises, from the action of the carbonated hydrogen gas, upon the body ; for as the miasmata are present, in unusual quantity, in those seasons, when bilious fevers prevail ; and, as they are capable of producing such diseases, nothing can be more probable, than that they have a principal share in producing them ; which will amount to proof positive, unless some other cause can be adduced. Only two other causes have been seriously assigned, viz. first, the great alternations of heat and cold, that occur in autumn : and secondly, a peculiar state of the atmosphere, which is alledged to exist at that time ; without which, it is said, the most concentrated miasmata, or any other causes are unable to produce such affections.—As to the first, it will be readily granted, that if such alternations of heat and cold were the principal causes of such diseases, they would be equally prevalent in all situations, whether town or country, mountain or valley ; nay, if anything, less frequent in towns and valleys than elsewhere, as they are less exposed to such varieties of temperature, than the contrary situations . But quite the opposite is the fact ; towns and low marshy countries being, nearly, the only situations, in which bilious intermittents are seen.—And nearly the same objection will hold good against the second cause alledged ; for a particular morbid state of the atmosphere, uninfluenced by, or independent on local circumstances, cannot be partial, but must be universal.

Thus, it will be found absolutely necessary to attribute the production of the bilious fever, to the marsh miasmata, or carbonated hydrogen gas ; unless, indeed, some may be inclined, with Mr. Webster, to ascribe all epidemics, to something mysterious and inscrutable derived from comets, or discharged from the bowels of the earth, by volcanos and earthquakes : But, as I am not much disposed to search after those volcanic poisons, and thinking the point already sufficiently decided ; I will now proceed to the last division of the subject.

Of the action of miasmata.—It has been much disputed of late, in what manner aeriform contagions, and the other infections of diseases enter the body ; whether by absorption from the lungs, and general external surface, or by a direct passage into the stomach, with the saliva. It would be curious, and perhaps important, to come at the truth on this point, if possible ; but as there are no present means of doing it, I shall content myself with examining the apparent effects of these noxious miasmata upon the human body ; the progress of which appearances is all that can certainly be know, of the *modus operandi* of these, or any other poisons, in producing diseases.

FROM the history of the bilious fever, already delivered, it will be found, that the first effects of the causes that induce that fever, are manifested, by a derangement of the functions of the alimentary canal and liver : But as the stomach more readily sympathizes with any slight general indispositions, than any other of the secretory organs, it should, probaby, be considered as the first part materially effected by the miasmata ; and

this opinion is rendered more likely, by the circumstance of strangers (who come from healthy situations, into places much contaminated by these noxious exhalations) being almost always affected, shortly after their arrival, by diseases of the alimentary canal ; such as cholics, diarrhœas, and cholera morbus : And it is no objection to this opinion, that the stomach usually discovers very little disorder, until after the liver has become affected ; for all, who understand the economy of that viscus, know how readily it must accommodate itself to new actions, departing very little from the appearance of health, at the very time when it is labouring under the influence of some of the most malignant poisons. It will bear almost any stimulus, without much manifestation of its struggles, provided it is not too suddenly introduced ; not rejecting opium, or mercury, when given in such quantities as to destroy life, or produce the most profuse salivation. But we are not thence to conclude, that the stomach suffers no injury ; indeed, fatal experience, often teaches the intemperate, the fallacy of such an opinion.—The late illustrious Darwin supposed that all aeriform contagions exerted their primary influence upon the stomach.

THE liver is either primarily affected by the absorption of the miasmata, from the lungs and cutaneous surface ; which afterwards reach it, by the course of the circulation, and act directly upon it ; or it is only affected secondarily, by its association with the stomach. The latter of which methods I am inclined to receive, from two arguments in its favor : first, it is difficult to conceive, how the miasmata could pass to the liver, without first considerably disordering the whole

absorbent system ; for the lymphatic system generally, is much more irritable than the secreting vessels of the liver, the former being only accustomed to the stimulus of the mildest fluids, while the latter is always conveying a fluid, much more stimulating than the miasm itself. Secondly, because I have a case in point, to prove that the liver may be highly deranged, by affections, originally, of the stomach alone : Mr. Scott, my fellow graduate, in making experiments upon opium, took a large dose, which acted very violently on his stomach, producing extreme nausea and vomiting ; I saw him twenty hours after taking the the opium, and at that time, (his nausea still continuing) he was puking bile, of so dark and morbid an appearance, that he compared it to the black vomit of the Yellow Fever. Before taking the opium he was in perfect health, except a slight tendency to dyspepsia, which probably caused the dose to act so violently. From this case, nothing can be more evident, than, that the violent derangement of the stomach produced a corresponding state of the liver, which was the cause of the morbid appearance of the bile. But, by whatever means, it may be, that the liver becomes first affected, when once completely deranged, it may be considered as the great source of all the succeeding appearances of the Bilious fever.

THE first effect of this derangement in the œconomy of the liver is, usually, an increased secretion of bile, for a short time ; which is manifested by the slight diarrhœas and dysenteries that prevail, for some time, before the epidemic commences ; but this does not commonly last long ; for, as the miasmata become more active and concentrated, the excretory vessels of the

liver appear to be in a state of constriction, or, as the French denominate it, *engorgement*; costiveness now follows, from the paucity of the bile, which deprives the intestines of their customary aperient stimulus; a small portion of bile is frequently absorbed by the vessels of the liver, and diffused through the body, giving the eyes and skin a jaundiced tinge. The circulation of the blood, thro' the *vena portarum*, being retarded, by the obstruction in the liver, dull pains, with sensations of fullness and oppression, take place in all the abdominal viscera, also great fulness in the hypochondriac region; and these symptoms, probably, give rise to those tormenting affections of the head, and that extreme anxiety and restlessness, that have been mentioned, in the history of the epidemic.

THE predisposition to the bilious fever having been once formed, by the causes and effects now stated, assisted probably, in some measure, by the variations of the temperature of the atmosphere, from morning cold to mid-day heat; the general character of the epidemic is given; and any irregularity will then be sufficient to excite a paroxysm of the disease. And the circumstances that follow the first fit, will be found to depend upon the circumstances of the place, the state of the predisposing debility and the habits and constitution of the patient, in which it occurs. —Having now finished, what I proposed to treat of, under the head of theory, I will conclude my essay, by a few suggestions relative to the state of predispositions to disease.

THE nature of a predisposition to disease may be considered, as a fragment of the great un-

fathomable law of propogation ; it seems to have the same relation to disease, that the seed of any fruit has to the fruit it produces ; for a predisposition to disease, as naturally and certainly produces its disease, under favourable circumstances, as a seed grows into a fruit. Ought not physicians to take the hint, from this analogy, and remember, that, though all young plants are easily pulled up by the roots, old ones frequently resist their utmost might ?—It becomes us therefore, as the seeds of diseases are frequently, like weeds, sown without our consciousness of it, to watch with attention for the first sprouts, and pluck them up, as soon as they appear ; and endeavour, if possible, to bring up the roots with them ; but never to suffer the young Scion to grow to a larger size, in hopes that, as the stalk increases, it will be more able to draw up the root with it ; for it often happens, that the root grows faster than any other part ; whereby we are, in the end, frequently obliged to apply the harshest means, and to mutilate a very large portion of the body, without, *at last*, being able to remove the evil ; whereas, had we made the due exertion in the *beginning*, all might have been effected, by a little exertion, with perfect ease, safety and certainty.

—*FINIS*.—

ERRATA.

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PAGE 9, line 6. for *ommission*, read *omission*.

10, - - 13. - - *inocuous*, - - - - *innocuous*.

16, - - 17. - - *redder*, - - - - *reddish*.

30, - - 5. - - *irksom*, - - - - *irksome*.

—, - - 33. - - *he*, - - - - - *the*.

37, - - 21. after *approaching* - *sometimes*.

37, - - 30. for *acrated*, - - - - *aerated*.

45, - - 9. - - *fair* - - - - - *fairest*

50, - - 35. - - *their* - - - - - *it's*.

56, - - 13. - - *region* - - - - - *regions*.

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